



SDC Procedure:
Product Development Process

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1.0 PURPOSE

The purpose of this document is to ensure that software work products (i.e., documents, computer code, and databases) developed by Systems Development Center (SDC) projects are prepared, reviewed, and delivered to the customer in a controlled manner. The aim of this control is to facilitate SDC project success and customer satisfaction.

The specific purposes of this procedure are the following:

- C To summarize the activities performed by SDC organizational elements (e.g., Development and Maintenance Methodology Group [DMMG], Project Development Teams, SDC Management Team, SDC Business/Contracts, Product Assurance [PA], and Technical Support Center [TSC]) in developing a product for delivery to the Environmental Protection Agency (EPA).
- C To describe the roles of the EPA Task Order Project Officer (TOPO) and the SDC organizational elements in performing these activities.

The activities in this procedure encompass the spectrum from SDC receipt of an EPA Statement of Work (SOW) to SDC delivery of a product to the customer. It is to be noted that this procedure is *not* intended to describe the *how to* of specific product development activities. This *how to* is defined in an approved SDC Project Plan. On the other hand, it should be recognized that the activities presented in this procedure are to be considered as planning factors for estimating required resources and deliverable schedules when preparing an SDC Project Plan.

It is to be noted that the *sequence* of activities defined in this procedure may be iterated, in whole or in part, one or more times during any particular product development effort.

2.0 BACKGROUND

Under EPA's Mission Oriented Systems Engineering Support (MOSES) Program, the SDC is the focal point for development and modernization of EPA's mission critical environmental information systems. This document summarizes the activities for standardizing the development of software work products associated with these information systems. The activities presented here utilize the concepts set forth in other SDC policies, guidelines, procedures, and standards. Copies of these documents are located on-line in the SDC Process Asset Library (PAL). The PAL is part of the SDC Web site.

Since MOSES is a cost reimbursable contract, the SDC contractors are required to provide “best engineering efforts” to accomplish the tasks detailed in the fully-executed Task Order SOW. The activities set forth in this process serve to define “industry accepted best engineering practice”. Therefore, invoking these activities to develop products and perform services establishes a basis for ensuring that these items, when delivered, are acceptable to EPA.

It should be noted that, for brevity, the remainder of this document generally uses the term “product” to encompass both “software work products” and “services.” In a few instances, it is necessary to distinguish between a “software work product” and a “service.” With the exception of those instances, everything described in this procedure applies to both software work products and services.

3.0 SDC PRODUCT DEVELOPMENT PROCESS OVERVIEW

Exhibit 1 presents a graphical overview of the process of planning, developing, and preparing SDC products for delivery to EPA. Exhibit 1 consists of the following elements:

- C EPA.
- C Major SDC Organizations.
- C EPA TOPO.
- C Change Control Board (CCB).
- C Major SDC System Development Activities.
- C Major Communications Paths.

These elements interact with each other at two levels — (1) the project level, which consists of activities associated with the development of information management products, and (2) the SDC level, which consists of activities associated with the SDC mission of coordinated and standardized development of EPA information management systems and their associated products. The first level arises from the fact that it is necessary to apply technical lessons learned to reduce false starts and avoid costly mistakes. The second level arises from the fact that the SDC is a multi-project environment; it is therefore necessary to leverage resources across projects and promote synergy among projects.

All the activities associated with these elements and their interactions need to be applied on each deliverable product. The degree of application of this process must be tempered with SDC management experience in allocating available resources consistent with schedule constraints. This prescriptive application of the SDC product development process provides the people responsible for developing the products with industry accepted techniques that help ensure successful product development.

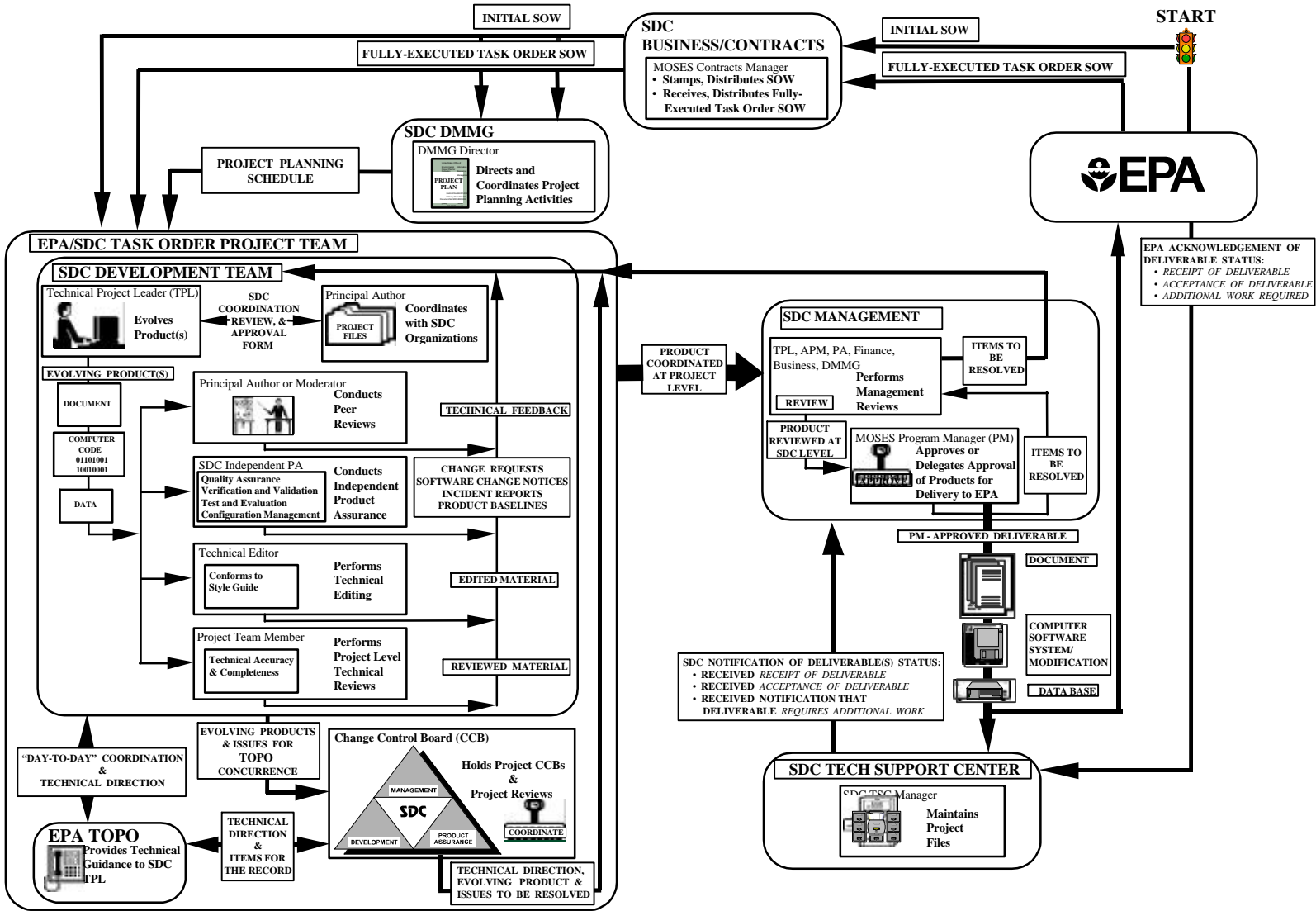


Exhibit 1. SDC Product Development Process Overview

Exhibit 1 is first explained in terms of the above elements and then in terms of how these elements interact during the product development process.

3.1 EPA

As depicted in Exhibit 1, EPA is the SDC customer who prepares an SOW indicating the work to be performed. The description of what EPA does to prepare an SOW is outside the scope of this document. However, the SOW starts the overall process of SDC planning, developing, and preparing of products for delivery to EPA.

As detailed below, a fully-executed Task Order SOW authorizes the work to be performed at the SDC. The EPA person responsible for overseeing the technical accomplishment of the work to be performed is a TOPO.

3.2 Major SDC Organizations

As shown in Exhibit 1, the major SDC organizations are as follows:

C SDC Business/Contracts

Business/Contracts provides facilities, financial, contract, subcontracts, purchasing, and human resources support for project work. The MOSES Contracts Manager is responsible for logging receipt of an EPA SOW, and immediately distributing the document to the SDC Management and DMMG Director. The MOSES Contracts Manager also receives and distributes the Task Order Modification that authorizes work to commence.

C SDC DMMG

The DMMG is part of the Process and Quality Engineering Division (P&QED). The DMMG is managed by a Director who provides leadership and is accountable to the MOSES Program Manager (PM) for its operation. The P&QED Manager can fill the role of the DMMG Director. The DMMG Director is responsible for (1) designing, assessing, and implementing SDC-specific systems development methodologies, (2) establishing and implementing policies, guidelines, procedures, and standards within the SDC Systems Engineering Environment (SEE), (3) directing and coordinating project planning, and (4) providing technical and process training. The Director is responsible for assembling DMMG project planning teams, directing their project plan development, and acting as the SDC point-of-contact with EPA during the project planning process.

C SDC Development Team

The SDC Development Team is tasked to perform the work set forth in the SDC Project Plan which is developed in accordance with the EPA SOW for the Task Order. The team consists of (1) a Technical Project Leader (TPL); (2) assigned personnel whose skills are matched to the requirements of the project plan; and (3) representatives from the independent PA organization who ensure that SDC policies, guidelines, procedures, and standards are followed.

At the project level, the TPL is the front line manager whose primary responsibility is to carry out the work specified to be done under the Task Order. Specifically, the TPL (1) develops and maintains a project plan with the DMMG Director that specifies task objectives, technical approaches, and deliverables; (2) works closely with the assigned PA staff or his representative to develop and implement a PA plan; (3) develops and maintains the project's detailed integrated schedule, tracks progress against the schedule, and modifies the schedule, with TOPO concurrence, when necessary; and (4) supervises the assigned staff in the day-to-day performance of the work.

C SDC Independent PA

The SDC Independent PA is part of the Process and Quality Engineering Division (P&QED). The P&QED Manager can fill the role of the PA Manager. The SDC Independent PA organization is managed by the PA Manager. The PA Manager is responsible for executing the PA program as documented in the *SDC SEE Statement Policy* and auditing the implementation of SEE requirements on each Task Order within the SDC. The process involves checks and balances, provided by skilled personnel in the disciplines of Quality Assurance (QA), Configuration Management (CM), Independent Verification and Validation (IV&V), and product acceptance testing. Task Order Product Assurance Leads (TOPAL) are assigned to interact with the SDC management in planning, implementation, and problem resolution activities. The TOPAL works directly with the APMs and TPLs. The TOPAL supervises assigned PA personnel and manages the day-to-day needs of PA on Task Orders. PA activities raise the visibility of the life cycle development process and infuse it with a discipline (e.g., traceability of requirements and testing) that makes the process manageable and auditable.

These activities mitigate risk through closed-loop corrective action mechanisms and increase the likelihood that the product is complete and maintainable, and that it conforms to repeatable EPA and SDC product development activities.

C SDC Management

At the SDC level, management consists of the APM, the DMMG Director, the Contracts Manager, and the MOSES PM.

The APM is also the SDC manager responsible for (1) reviewing (in coordination with the DMMG) products for conformance with SDC policies, guidelines, procedures, and standards to promote consistent product development; (2) leveraging resources across existing and planned projects to improve efficiency of the SDC; (3) promoting information sharing among Task Orders to support cost-effective, efficient systems development, and development of non-redundant, correct, consistent, and complete data; (4) working with the DMMG in the development and update of SEE elements; and (5) providing overall technical oversight and guidance for assigned projects.

The MOSES PM is responsible for all work accomplished at the SDC. As such, the PM is responsible for ensuring that work is accomplished at the SDC using “best engineering effort.” This responsibility includes review and approval of all SDC policies, guidelines, procedures, and standards governing SDC work. The PM can delegate product approval and release authority to an APM or TPL.

C SDC Technical Support Center (TSC)

The SDC TSC is part of the Process and Quality Engineering Division (P&QED). The TSC is responsible for establishing and maintaining project files (in coordination with the SDC Development Team) that serve as repositories for SDC deliverables. The TSC also provides technical editing of reviewed material (or support to a technical editor who is a member of an SDC Development Team), and graphical and schedule chart preparation support for project deliverables and plans. Technical editing includes checking for grammar, uniformity of style, syntax, and semantics. If requested by an SDC Development Team, the TSC will be responsible for the final format and reproduction of a product for delivery to EPA. In addition, the TSC maintains a technical resource library of project and EPA reference materials.

3.3 EPA TOPO

The EPA TOPO is the counterpart to the SDC TPL. The TOPO or designated Alternate TOPO (ATOPO) monitors the SDC Development Team's progress in performing the project plan tasks. The TOPO provides *all* technical direction to the TPL, who in turn guides the efforts of the individual SDC Development Team members.

3.4 Change Control Board (CCB)

As a project progresses, both the TOPO and the SDC Development Team mature in their understanding of what needs to be done. These project dynamics result in the need to refine planned activities. To specify and agree to refinements that are within the scope of the project plan, the TPL, in concert with the TOPO, uses a project CCB as a forum for recording the agreed upon refinements. At a minimum, SDC projects hold a CCB meeting at least once a month.

The CCB is a management support tool that facilitates effective communication and accomplishment of the planned work among the following three groups of complementary disciplines: management, development, and PA. In general, each group may have representatives from contractor organizations, government organizations, or both organizations. When contractor and government representatives hold a CCB, the minutes are written to detail the discussion, decisions, and assigned action items. The TOPO approves the minutes at the following CCB meeting. The CCB Meeting minutes are posted to the SDC Web site at Research Triangle Park by the SDC Web Council.

The CCB allows EPA and SDC Development Team members to assimilate, and iterate on, the refinements to the planned activities of an SDC Project Plan. To formalize this process, these refinements are captured in CCB Minutes that record guidance and agreements for subsequent actions taken. If the TOPO and TPL agree in the CCB that a project deliverable date change is needed, the TOPO notifies the EPA MOSES Contracting Officer (CO), explaining the reason and justification for the change. The CO provides notification to the contractor that the date change is acceptable. The TPL enters the new deliverable date in the next Technical Issues Briefing and Monthly Technical and Financial Progress Report (MTFPR), records the change in the CCB Minutes, and updates the project's detailed integrated schedule.

In general, the output of the project CCB consists of technical direction, evolving products, or issues to be resolved. The SDC Development Team may need to respond to the results of the CCB and evolve the product. The end result of coordination between the SDC Development Team and the TOPO is a product coordinated at the project level. The product is now ready to be elevated to the SDC level for review by the appropriate APM or DMMG Director. Details on conducting CCBs can be found in *SDC Guideline: Change Control Board (CCB)*.

4.0 MAJOR SDC PRODUCT DEVELOPMENT ACTIVITIES

There are a number of product development activities that define the administrative and management oversight ways of “doing business” at the SDC.

4.1 Product Development Activities

These activities are grouped into the following three separate procedures:

- C Developing, Coordinating, and Delivering a Project Plan - This procedure describes the development, coordination, and delivery of an SDC Project Plan and the roles performed by the SDC organizational elements.
- C Completing Project-level Product Development Activities - This procedure details the various product development activities that a product must undergo before it is ready to begin the coordination, review, and approval process at the SDC.
- C Coordinating, Reviewing, and Approving an SDC Deliverable - This procedure details the steps for completing the SDC Deliverable Coordination, Review, and Approval Process for a software work product or other deliverable.

All of these procedures contain detailed information and are located on-line in the SDC PAL. These activities are designed to facilitate interaction within the SDC Development Team and the assigned EPA staff, thereby resulting in a product that meets EPA requirements. These activities are taken into consideration by the DMMG project planning team when responding to an SOW. The project planning team defines (1) the *specific* SDC systems engineering tasks and, (2) the required resources, and the schedule to perform the specified systems engineering tasks. As these specific systems engineering definitions are constructed, the project planning team applies resource estimates to the product development activities.

All these product development activities need to be performed to some degree and in some order on any SDC project. The “degree” of application and “sequencing” of these development tasks are a function of the (1) goals and scope of the project, and (2) resources and time available to complete the project. In concert with the DMMG Director, the TOPO and the DMMG project planning team agree upon how the development activities are incorporated into the project plan. These activities are designed to reduce the risk associated with product development by integrating them with specific product development activities.

4.2 Providing Technical Guidance to the SDC TPL

Throughout the period of performance, a TOPO often needs to communicate with the TPL for the purpose of providing technical guidance (i.e., “day-to-day” coordination, and technical direction) to ensure that EPA’s desired results are achieved. The need for this communication arises because both the TOPO and the SDC Development Team (including the TPL) mature in their understanding regarding what needs to be done next as the project proceeds.

Daily communication is often necessary to ensure success of the effort. The “day-to-day” coordination between the TOPO and the SDC Development Team is accomplished through the TPL, who in turn supervises members of the SDC Development Team. The TOPO communicates directly with the TPL—not with the individual members of the SDC Development Team. This communication path provides the TOPO with a single point of contact for daily interaction. This path also ensures that the TPL maintains cost and schedule control over the work to be performed. The responsible APM or the PM provides the TOPO with alternative communication paths if the TPL and designated backup are not available.

When the interaction between the TOPO and the TPL involves technical direction, the Technical Direction Clause (i.e., H.19) of the MOSES Contract is invoked. This clause mandates technical personnel (i.e., TOPO) to communicate with the contractor (i.e., SDC TPL) regarding the work effort. The TOPO is not allowed to give technical direction to individual members of the SDC Development Team. The TOPO is responsible for providing technical direction on individual Task Orders. Regarding this direction, a frequently occurring situation deserves special attention—namely, schedule adjustments. The TPL manages the work detailed in the SDC Project Plan. The plan specifies deliverable products and associated delivery dates. As the project matures, adjustments to deliverable schedules set forth in the project plan may be necessary. Schedule adjustments for deliverables are acceptable as long as they: (1) are mutually agreed to by the TOPO and TPL and documented in a CCB; (2) are noted as changes in the MTFPR; (3) do not extend beyond the period of performance; and (4) do not alter the project cost ceiling. The TOPO has the responsibility for obtaining CO approval on these changes. These changes cannot go into effect until the CO approves them. Technical direction also includes comments on or approval of deliverables.

The TOPO is not allowed to issue technical direction constituting a change as follows:

- C Institutes additional work outside the scope of the MOSES Contract or the individual Task Order SOW.
- C Causes increases or decreases in the estimated cost ceiling of the fully-executed Task Order SOW, such as putting active tasks or subtasks on hold, or downscoping the Task Order level of effort.

- C Alters the fully-executed Task Order SOW period of performance.
- C Changes the express terms and conditions of the MOSES Contract.
- C Takes the form of a new Task Order.
- C Gives technical direction directly to project personnel instead of the TPL (i.e., no personal service.)
- C Changes deliverable due dates or deletes deliverables without CO approval.
- C Recommends/requests/refuses to have specific qualified contractor personnel assigned to work on a Task Order or work assignment.
- C Suggests a promotion, bonus, or other performance award for specific contractor personnel.

The TPL is responsible for informing the TOPO that the TOPO has communicated guidance that does not constitute valid technical direction under the existing fully-executed Task Order SOW. If the TOPO wants the guidance to be incorporated into the existing Task Order, the TOPO is required to prepare a revised SOW to modify the existing Task Order. Subsequently, EPA issues a Task Order Modification instructing the DMMG Director to develop a revised SDC Project Plan in accordance with the revised SOW.

In general, the TOPO and TPL frequently communicate via telephone, e-mail, or face-to-face. When these interactions involve technical direction, the MOSES Contract requires that the direction be committed to writing. The contract states that “technical direction is issued in writing by the TOPO or confirmed by him/her in writing within 5 calendar days after verbal issuance.” All technical direction is forwarded by email to the Project Officer as directed in the MOSES Contract (H.19[e]). The email address is MOSESIITDD@epa.gov. There are a number of ways in which this requirement can be met, and several alternatives are offered as follows:

- C When the technical direction is communicated via telephone or in face-to-face meetings, it is recommended that a CCB be convened within 5 calendar days so that a record of the verbal technical direction can be incorporated into the meeting minutes.
- C When the technical direction is verbal, and it is not convenient to hold a CCB meeting within 5 calendar days, it is recommended that e-mail be used to record the direction. Subsequently, the e-mail message(s) can be appended to the minutes of the next CCB meeting.

- C When the technical direction is communicated via e-mail, it is recommended that the hard copy of the e-mail message containing the direction be appended to the minutes of the next CCB meeting.
- C The technical direction can also be documented in a memorandum for the record and then attached to the minutes of the next CCB meeting.
- C Technical direction is also documented in the MTFPR.

4.3 Delivery of a Product to EPA

The responsible TPL or the TSC delivers the following material to EPA for each product:

- C Signed cover letter.
- C Receipt of Deliverable form.
- C Acceptance of Deliverable form.
- C Copies of the product or a letter detailing the service provided (e.g., training, conference support, demonstrations, hotline support) to the customer in accordance with the instructions indicated in the cover letter, as required by the contract.

The TPL may also deliver a product to the TOPO electronically via e-mail. In this case, the TPL should include the text of the cover letter in the body of the e-mail and the Receipt of Deliverable form, the Acceptance of Deliverable form, and the product as attachments. The TPL should print a copy of the e-mail and include it in the product's folder for filing in the SDC Project Files. Other methods of electronic delivery are possible. All methods should be presented and receive approval by the DMMG Director and the MOSES PM.

The TSC also ensures that the SDC Metrics Database, SNAPSHOT, is updated to record the fact that the product was distributed.

4.4 Receipt of a Product by EPA

When the product is delivered to the TOPO (or designated EPA representative), the TOPO signs and dates the Receipt of Deliverable form. If the TPL delivers the product, the TOPO may provide the completed receipt form to the TPL. If a commercial courier is employed to deliver the product, the TOPO completes the receipt form which is self-addressed, and returns it to the SDC. If the product was delivered electronically, then the TOPO may either print and return the Receipt of Deliverable form or send an e-mail to the TPL stating the product's PCN and the date the product was received. When the TSC receives the returned receipt form or a copy of the TOPO's e-mail from the TPL, the SDC Deliverable Coordination, Review, and Approval form and SNAPSHOT are updated.

4.5 Acceptance of a Product by EPA

The Acceptance of Deliverable form is also tracked in a similar manner. Upon receipt and review of the deliverable, the TOPO completes this form. If the product was delivered electronically, then the TOPO may either print and return the Acceptance of Deliverable form or send an e-mail to the TPL stating the product's PCN, and the date, and how the product was accepted. The TSC receives the returned acceptance form or a copy of the TOPO's e-mail from the TPL, and updates the SDC Deliverable Coordination, Review, and Approval form and SNAPSHOT. All TPLs have access to SNAPSHOT. There are three acceptance possibilities: (1) accepted as written, (2) accepted with minor changes, or (3) rejected, requires changes to be discussed.

When the deliverable is "accepted as written," no further action is needed after SNAPSHOT and the SDC Deliverable Coordination, Review, and Approval forms have been updated.

When the deliverable is "accepted with minor changes," the TSC Manager notifies the responsible TPL that the deliverable product was accepted, but minor changes are required. If the minor changes can be incorporated into the deliverable with remaining Task Order resources, and within the period of performance, then the deliverable should be revised and re-delivered to EPA. The TOPO can revise the SOW to extend the period of performance (and add funding, if necessary).

When a deliverable is rejected, the TSC Manager notifies the responsible TPL and APM that the deliverable requires changes to be discussed with the TOPO.

To complete the Project Files for audit purposes, the TPL is responsible for coordinating with the TOPO to ensure that these forms are completed and returned to the TSC.

4.6 Work-In-Progress Deliverables

Occasionally, a TOPO might want to review a deliverable prior to its completion. Interim, work-in-progress reviews of deliverables provide insight into product development. A work-in-progress deliverable can be provided to the TOPO in the form of a draft document, access to pre-production code, or access to pre-production database. If a waiver has been received from the EPA Technical Manager, a TPL can put in production or release untested or partially tested software from the SDC. The SEE element, *Handling Interim Work-in-Progress Communications with the Environmental Protection Agency (EPA)*, contains detailed information on this topic.

5.0 SDC PROJECT FILES

The concept of *SDC Project Files* is integral to the product development process and explained in detail in the subsections below. The TSC Manager is responsible for many activities associated with the SDC TSC.

5.1 Contents

SDC Project Files consist of all contract deliverables; product receipt and acceptance forms (or other acceptance confirmation documentation), additional project documentation such as working papers and correspondence; CCB Minutes; Purchase Request Orders; and additional materials as required by the TOPO, APM, or TPL for each Task Order. A product may physically reside in the SDC Project Files or at a location designated by the principal author as agreed to by the TOPO. When the product is not filed at the TSC, the product's location is cross-referenced in the SDC Project Files.

5.2 Product Control Number (PCN) Assignment

The TSC assigns Product Control Numbers (PCN) to all deliverable products created under each Task Order. These numbers are maintained by the TSC in SNAPSHOT. When work begins on a product, the principal author must coordinate with the TSC to label the product. This labeling is summarized as follows:

- C *Documents* are assigned a PCN by the TSC.
- C Computer code is assigned a release number in accordance with each project's software CM plan and the deliverable is assigned a PCN by the TSC.

- C *Databases* are assigned a PCN or release version number in accordance with each project's database CM plan.

The format of the PCN for documents is depicted in Exhibit 2.

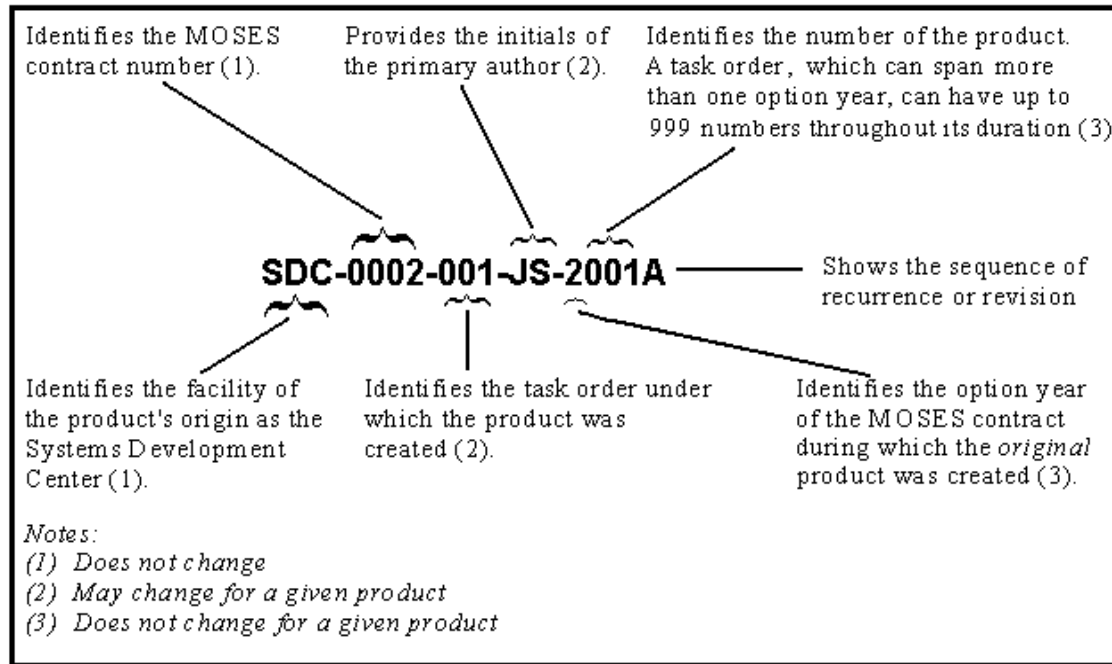


Exhibit 2. Product Control Number Format

- C The first two fields apply to all SDC deliverable documents, and do not change.
- C The third field identifies the Task Order number under which the *current* version of the document was created. This linkage satisfies a MOSES contractual requirement. This number will change if another draft or version of the document is subsequently delivered under a different Task Order.
- C The fourth field shows the first and last name initials of the current document's principal author. The principal author's name also appears on the SDC Deliverable Coordination, Review, and Approval form. This is the person to be consulted on any issues, questions, or other matters concerning the document's contents. This field will change if a new principal author is assigned to a later draft or version of the document (unless their initials happen to coincide).

- C The fifth field contains a four-digit number that does not change throughout the document's lifetime. The first digit is the MOSES Contract option year number during which the document was first created. The next three digits identify the Task Order sequence number that the TSC assigned to the document when it was first created.
- C The final element in this field is a letter, starting alphabetically with "A," that identifies each update or revision to the original document. Letter designators are not reset if the Task Order number should be changed.

The PCN and date of delivery appear as a header on each page of any deliverable document. In summary, this header conveys the following information:

- C The document is an SDC deliverable under the MOSES Contract.
- C The Task Order under which the current document was produced.
- C The initials of the principal author at the time the current document was created, revised, or updated.
- C The MOSES Contract option year and original Task Order sequence number assigned to the document.
- C By alphabetical sequence, the number of revisions or updates incorporated in the document, if any.
- C Delivery date for the current document.

Questions or comments concerning assignment and use of PCNs should be directed to the TSC.

5.3 PCN Revisions

For products that are recurrent in nature (such as MTFPRs and CCB Minutes) or revisions to a previously delivered product, the base number remains the same and an alpha-character is appended at the end to reflect the sequence of the revision or the next recurrence of the product. Each recurrent product or revised product must be registered in SNAPSHOT. The principal author is responsible for obtaining the correct product control number from the TSC. TPLs can obtain PCNs with a revision ending directly from SNAPSHOT for CCBs and MTFPRs. If the PCN is not obtained through this procedure, the Task Order product may not be registered correctly.

5.4 Access to Files

The TOPO must make arrangements with the project's TPL to access the SDC Project Files. When accessing the SDC Project Files, a person must be accompanied by a TSC monitor. To ensure that files are not removed or improperly re-filed, assistance of the TSC staff should be requested when there is a need for reproduction of either the hard copy or electronic copy of a product. The Project Files will be locked at the close of the TSC business day.

5.5 Document Copies

Technical Support Request (TSR) forms are available in the TSC for use in obtaining copies of SDC documents. To obtain either a hard copy or electronic copy of a document, this form should be completed and provided to the TSC Manager.

5.6 Closed Project Files

When a project is closed, an audit of the products will be conducted by the PA staff to ensure that the closed files contain the project's products listed in the Project Plan and SNAPSHOT. The closed files will be separated from the active SDC Project Files.

5.7 Archiving

Good filing management procedures necessarily include eventual archiving of SDC Project Files. Task Order files will be archived by the option year at the request of the TOPO or EPA Technical Manager (TM). Active files include the present option year and the year immediately preceding.